PROC. ENTOMOL. SOC. WASH.
92(4), 1990, pp. 765–770

DESCRIPTIONS OF THE LARVA AND PUPA OF *FLAVOHELODES THORACICA* (GUÉRIN-MÉNEVILLE) WITH NOTES ON APHYTOTELMA ASSOCIATION (COLEOPTERA: SCIRTIDAE)

JAMES B. STRIBLING AND DANIEL K. YOUNG

(JBS) Department of Biology, 37th and O St., NW, Georgetown University, Washington, D.C. 20057; (DKY) Department of Entomology, 1630 Linden Drive, University of Wisconsin, Madison, Wisconsin 53706. Current address: (JBS) EA Engineering, Science, & Technology, 15 Loveton Circle, Sparks, Maryland 21152.

Abstract.—Descriptions of the larva and pupa of *Flavohelodes thoracica* (Guérin-Méneville) are given and based on specimens collected and reared from a phytotelma (water-filled treehole) in a *Quercus* sp. These descriptions are presented in order to facilitate the recognition of immature *F. thoracica* and to document the occurrence of this species in phytotelmata. Morphological comparisons are made with *F. flavicollis* (Kiesenwetter). The status of phytotelmata as a habitat association with the genus is briefly discussed.

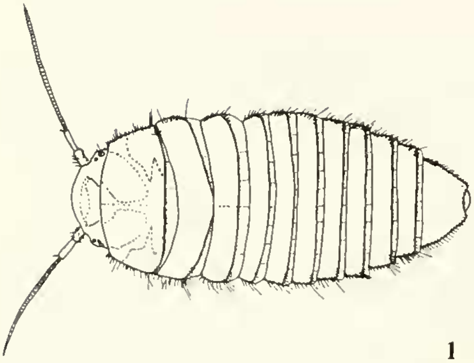
Key Words: immature stages, phytotelmata, Scirtidae, *Flavohelodes*

Scirtidae larvae inhabit a wide variety of restricted lentic habitats including phytotelmata (e.g. water-filled treeholes, tank-forming Bromeliaceae); shallow, leafy groundpools; and leaf packs in nearly still waters of stream sidepools. Larvae are relatively easily collected from these habitats, occasionally in large numbers. In spite of this and the relative ease of rearing, life stages or species/habitat associations have been published for few species of Scirtidae. Among those treated in detail are *Prionocyphon discoideus* Say (Osten-Sacken 1862, Snow 1958a, b), *P. serricornis* Müller (Benick 1924, Rohnert 1951, Horion 1955, Kitching 1969, 1971, 1983), *P. niger* Kitching and Allsopp (1987), *Scirtes championi* Picado (1913), and *Flavohelodes flavicollis* (Kiesenwetter) (Klausnitzer 1980).

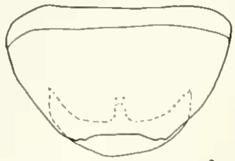
Klausnitzer (1974) recognized the *Elodes flavicollis* species group as distinct from the remaining species of the genus. Later, he (Klausnitzer 1980) elevated this species group to generic status, naming it *Flavohelodes*. This action was partially based on larval mouthpart and antennal modifications which he interpreted as adaptations to phytotelmata. Klausnitzer (1980) also reported the larval stages of *F. flavicollis* (Kiesenwetter) as having been recently discovered inhabiting water-filled treeholes in Europe. This represents the sole source of published microhabitat data for the genus until now. In this paper, we add another with the description of the larval and pupal stages of *Flavohelodes thoracica* (Guérin-Méneville) which were collected and reared from a *Quercus* phytotelma near Great Falls, Montgomery Co., Maryland.

METHODS

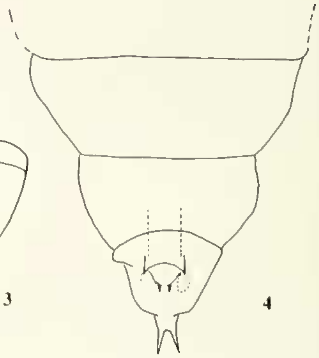
Collection and rearing.—Loose leaves and the leaf pack at the bottom of the treehole were removed by hand and long forceps and sorted in a white porcelain pan. Some larvae were immediately placed into vials contain-



1

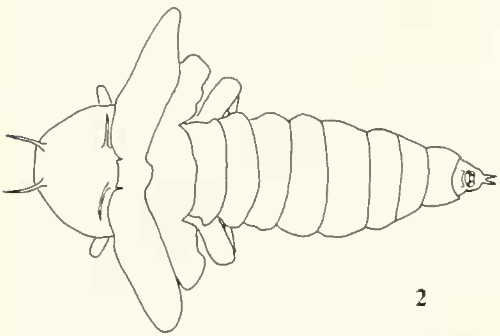


3



4

Figs. 3, 4. *Flavohelodes thoracica* (Guérin-Méneville). 3. larva, abdominal terga 8–9, dorsal view; 4. pupa, apical abdominal segments, dorsal view.



2

Figs. 1, 2. *Flavohelodes thoracica* (Guérin-Méneville), 1. larva, dorsal habitus, dotted lines on pronotum indicate patterns of melanization, the median, longitudinal vitta and the anterolateral arms being lighter; 2. pupa, dorsal habitus.

ing 70% ethanol for preservation. The remainder were segregated into plastic containers with leaf litter and water from the phytotelma, and returned to the lab. Water was removed by siphoning with rubber laboratory tubing or commercial basting syringe.

Larvae to be reared were placed into 4–6 dram glass, stoppered vials. Each vial was partially filled with treehole water and a few leaf fragments from the original treehole. Personal observations have demonstrated that mature larvae crawl out of the water to pupate, attaching the abdominal apex to the leaf surface. Since attachment to the glass walls of a vial has not been observed, it may be essential to orient the leaf fragments so that portions of them protrude well above the level of the water.

Dissections and illustrations.—Dissections were performed in 70% ethanol. Dissected structures were cleared in an aqueous KOH solution, rinsed in distilled water, and observed in glycerine. The dissected structures were stored in genitalic microvials with a drop of glycerine; these microvials were than placed in glass alcohol vials along with the remainder of the specimen.

Habitus illustrations were drawn with the aid of a camera lucida attached to a Wild M5A dissecting microscope. Mouthpart illustrations were prepared using a microprojector. Actual preparation of dissections for illustration were with the K-Y procedure as described by Young and Stribling (1990).

In the following description, terms for mouthpart and abdominal characters of the larva were translated directly from or modified after Hannappel and Paulus (1987). Some terms in the pupal description were adopted from Rozen (1963).

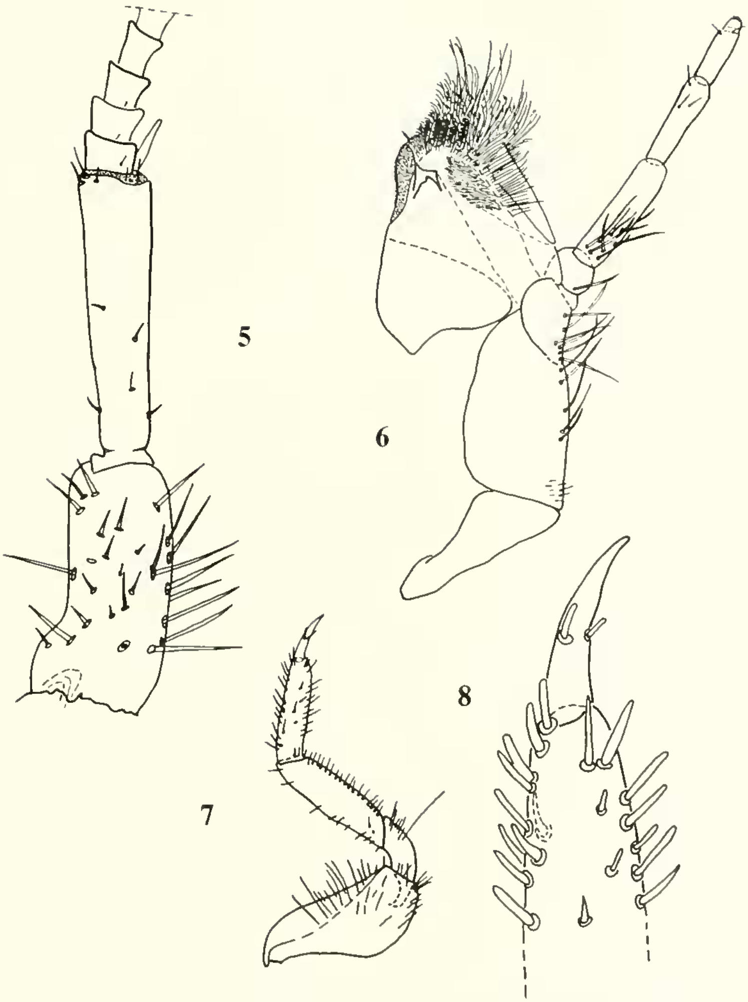
Voucher specimens are deposited in the personal collections of the authors (DYCC, Madison, Wisconsin and JBSC, Woodbridge, Virginia).

Flavohelodes thoracica (Guérin-Méneville)

Description.—Mature larva (Figs. 1, 3, 5–12).

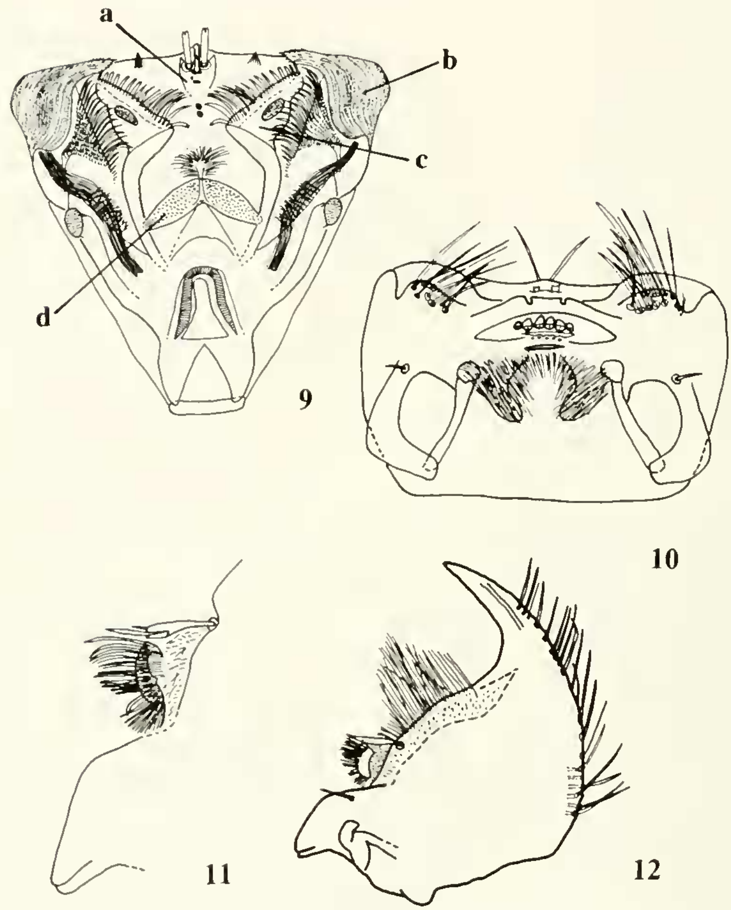
Body size.—Length 6–10 mm, most specimens 7–9 mm; maximum width (usually in thoracic area) 1–2 mm.

Head.—Antennal scape ca. ⅘ length ped-



Figs. 5–8. *Flavohelodes thoracica* (Guérin-Méneville), larva, 5. basal antennal segments, dorsal view; 6. left maxilla, ventral view; 7. metathoracic leg; 8. mesothoracic tarsus and tarsungulus.

icel (Fig. 5), 37–43 flagellomeres (Fig. 1), scape with larger and approx. 2× as many setae on medial surface as on lateral aspect; pedicel with 10–12 small, unevenly scattered setae, apically with 4–6 small setae, and a single, very large, stout seta mesally on apex (Fig. 5); 3 non-melanized stemmata either side of cranium in a dorsal, anterior-posterior row; anterior stemma separated from posterior pair by melanized band; row of large subocular setae; clypeolabrum (epipharynx) (Fig. 10) with ventral lobes not protruding anteriorly past margin of clypeolabral forewall, 6 teeth anterad of 5 subdental sensilla; mandibular prostheca (Figs. 11, 12) of 2 main sections, proximal sclerite with row of setae, and large, distal compound macroseta with main body socketed to the mandible and 2–3 distal subdivisions; mola cleft proximally; maxilla (Fig. 6) with 3 palpomeres, 5 galeal comb setae visible in ventral view; lacinial setal area of short, dense pile of mesally directed setae; hypopharynx (Fig. 9) with two apically notched hypopharyngeal teeth, setigerous sclerite (Fig. 9a) with two long setae and four cam-



Figs. 9–12. *Flavohelodes thoracica* (Guérin-Méneville), larva, 9. hypopharynx, dorsal view; a—setigerous sclerite, b—grip apparatus, c—comb plate, d—central compress; 10. clypeolabrum (epipharynx), ventral view; 11. left mandible, mola, and prostheca, ventral view; 12. left mandible, ventral view.

paniform sensilla, usually arranged in row (specimen figured has one lateral sensillum apically offset); one pair of medial campaniform sensilla proximad to setigerous sclerite; comb plate (Fig. 9c) with oval setal patch bearing 18–20 teeth; grip apparatus (Fig. 9b) covered anterolaterally with short, fine setae, posteriorly covered with thicker, more distinct setae (much longer on mesal margin); setal cluster near the anterior margin between setigerous sclerite and grip apparatus; central compress (Fig. 9d) wing-shaped, completely covered with tiny tubercles; labium broad, each palpus of 2 palpomeres.

Thorax (Fig. 1).—Mediodorsal length ratio (pro- : meso : metathoracic nota) 2:1:1; paler bands of melanization extend from anterolateral pronotal angles to midpoint of posterior pronotal margin, meso- and metathoracic nota somewhat paler at middorsal line; notal setation sparse except at margins, setae usually of increasing length from anterior to posterior angles; nota punctate, punctations evenly distributed, each with single, short fine seta; prothoracic legs (Figs. 7, 8) slightly shorter than meso- and metathoracic legs, other features invariant; coxae (Fig. 7) transverse (some appear conical if larva has inflated in preservation), sparsely setose, most setae dispersed on ventral and anterior surfaces; femur with two longitudinal, parallel rows of strong setae on outer surface, continuing around tibial insertion; tibia with stout setae on lateral and mesal surfaces, setation sparse anteriorly and posteriorly; tarsungulus (Fig. 8) with two strong, subapical setae; meso- and metathoracic sterna with intercoxal patches of long setae.

Abdomen (Fig. 1).—Eight visible segments, gradually decreasing in circumference and increasing in mediodorsal length posteriorly; punctation and setation similar to thoracic nota; tergum eight (Fig. 3) emarginate and slightly concave apically, ninth tergum as in Fig. 3.

Pupa (Figs. 2, 4).—Body length 5.5 mm; head smooth; dorsally covered with short, fine setae concolorous with cuticle; pronotum with two anterior and two posterior spines ("tubercles" of Rozen [1963]); elytra long, approx. ⅓ body length, projecting postero-laterally; nine abdominal segments, segment nine with short, bifurcate, terminal projection, ninth tergum (Fig. 4) with blind posterior pit, bounded dorsally by sclerite with 2 acute, lateral apices, and ventrally with 2 small spines.

Material examined (and repositories): MARYLAND, Montg. Co., near Great Falls, 02 June 1987, J. B. Stribling & W. E. Steiner/reared from larva in water from tree hole (14 larvae, 2 exuviae, 1 pupa, 3 adults; DYCC); (same data)/in water from tree hole (13 larvae; 7 DYCC, 6 JBSC).

Comparisons with *Flavohelodes flavicollis* (Kiesenwetter)

Comparisons of *F. thoracica* are based on descriptions in Hannappel and Paulus (1987). Some structures are unavailable for comparison because they have not been described in prior publications and the lack of specimens of *F. flavicollis.* Those which are common to our studies are discussed here.

Hypopharynx (Fig. 9).—Near the anterior margin between the grip apparatus and the setigerous sclerite there exists a cluster of setae which is lacking in *F. flavicollis.* A further difference is the existence of a row of heavier spines or setae on the anterior surface of the grip apparatus in *F. flavicollis* that is lacking in *F. thoracica.*

Clypeolabrum (Fig. 10).—In *F. flavicollis,* the ventral lobes are protruding past the anterior margin, there are 6 subdental sensilla, the setation of the anterior lobes is more uniform and stouter, the pair of medioanterior setae is short, and the lateral setation is abundant. In contrast, in *F. thoracica,* the ventral lobes do not protrude past the anterior margin, there are 5 subdental sensilla, the setation of the anterior lobe is less uniform and less stout, the pair of medioanterior setae is longer, and lateral setation is lacking.

Mandible (Figs. 11, 12).—The main species differences exist in the form of the prostheca. In *F. flavicollis* this structure is not setose and does not have an associated compound macroseta as is found in *F. thoracica.*

Maxillary palpus (Fig. 6).—Setal abundance and distribution are similar in the two species. In palpomere 1 of *F. thoracica* setation is more proximal than that of *F. flavicollis* which is more evenly and longitudinally distributed.

Status of the *Flavohelodes*/phytotelmata association

In his paper elevating the *flavicollis* species group to generic status, Klausnitzer (1980) hypothesized phytotelmata use as an ecological synapomorphy. Here, we have documented hardwood phytotelmata as a habitat for larval development of *F. thoracica* in support of this hypothesis. Although this study confirms phytotelmata use, we still know little of the degree of habitat specificity for this species. For example, are phytotelmata necessary for *F. thoracica* development or is it only one of the many potential breeding sites?

Frank and O'Meara (1985) found habitat segregation by oviposition site preference in bromeliad-breeding *Wyeomyia* spp. (Diptera: Culicidae) and attributed this to both microhabitat and macrohabitat differences. Preference of *Tillandsia utriculata* Linnaeus over *Catopsis berteroniana* (Schultes) Mez ex de Candolle (Bromeliaceae) phytotelmata for oviposition was interpreted as a microhabitat difference. In another experiment reported in the same paper, bromeliads in shaded habitat were found to be preferred for oviposition over those in nonshaded locations. The shaded vs. non-shaded habitats were interpreted as macrohabitat differences.

In order to categorize our *F. thoracica*–phytotelma association as microhabitat or macrohabitat, in the sense of Frank and O'Meara (1985), as well as further testing of Klausnitzer's (1980) hypothesis, more must be known about the ecological distribution of this species. Further collection and rearing of scirtid larvae from hardwood phytotelmata and other potential breeding sites, with documentation of habitat specifics, will allow these questions to be answered.

Acknowledgment

We are grateful to W. E. Steiner (Department of Entomology, Smithsonian Institution, Washington, D.C.) for accompaniment in the field and for his suggestions; to P. J. Spangler (Entomology, Smithsonian Institution) and D. R. Whitehead (USDA—Systematic Entomology Laboratory, Washington, D.C.) for providing space and equipment; and, to M. Rodón-Naviera, P. Thaler, and E. Barrows (Georgetown University) for comments and suggestions on earlier drafts of the manuscript. We thank several anonymous reviewers for well-taken suggestions.

Literature Cited

Benick, L. 1924. Zur Biologie der Käferfamilie Helodidae. Mitt. Geog. Gesell. Naturhist. Mus. Lübeck (2)29: 45–47.

Frank, J. H. and G. F. O'Meara. 1985. Influence of micro- and macrohabitat on distribution of some bromeliad-inhabiting mosquitoes. Entomol. Exp. Appl. 37: 169–174.

Hannappel, U. and H. F. Paulus. 1987. Arbeiten zu einem phylogenetischen System der Helodidae (Coleoptera)—Feinstrukturuntersuchungen an europäischen Larven. Zool. Beitr. N. F. 31: 77–150.

Horion, A. 1955. Faunistik der Mitteleuropäischen Käfer. Band 4. Eigenverlag, München.

Kitching, R. L. 1969. A preliminary note on the fauna of water-filled tree-holes. Entomologist 102: 7–9.

———. 1971. An ecological study of water-filled treeholes and their position in the woodland ecosystem. Ecology 40: 281–302.

———. 1983. Community structure in water-filled treeholes in Europe and Australia—comparisons and speculations. *In* Frank, J. H. and L. P. Lounibos, eds., Phytotelmata: Terrestrial Plants as Hosts for Aquatic Insect Communities. Plexus Publ., Inc., Medford, N.J. 293 pp.

Kitching, R. L. and P. G. Allsop. 1987. *Prionocyphon niger* sp. n. (Coleoptera: Scirtidae) from water-filled treeholes in Australia. J. Aust. Entomol. Soc. 26: 73–79.

Klausnitzer, B. 1974. Anwendung der Phylogenetischen Systematik innerhalb von Gattungen, dargestellt am Beispiel der Gattung *Helodes* Latreille 1796 (Coleoptera, Helodidae). Zool. Jb. Syst. 101: 479–559.

————. 1980. Bemerkungen zur Kenntnis der Helodidae Bulgariens mit Beschreibung einer neuen Art der Gattung *Helodes* Latreille. Entomol. Blatt. 76(1): 58–64.

Osten-Sacken, R. 1862. Descriptions of some larvae of North American Coleoptera. Proc. Entomol. Soc. Phil. 1: 105–130.

Picado, C. 1913. Les Bromeliacées epiphytes considerées comme milieu biologique (1). Bull. scientifiques France et Belg. 47: 215–360.

Rohnert, U. 1951. Wassererfullte Baumhohlen und ihre Besiedlung. Ein Beitrag zur Fauna dendrolimnetica. Arch. Hydrobiol. 44: 472–516.

Rozen, J. F. 1963. Preliminary systematic study of the pupae of Nitidulidae (Coleoptera). Amer. Mus. Novit. 2124: 1–13.

Snow, W. E. 1958a. Stratification of arthropods in a wet stump cavity. Ecol. 39: 83–88.

———. 1958b. Vertical and horizontal stratification of insect communities in wet tree cavities. Proc. 10th Int. Congr. Entomol. 2: 697.

Young, D. K. and J. B. Stribling. 1990. Systematics of the North American *Cyphon collaris* species complex with the description of a new species (Coleoptera: Scirtidae). Proc. Entomol. Soc. Wash. 92: 194–204.